Sensitivity analysis on ammonia shipping as a hydrogen carrier

For: MSc or PhD Students; 12 months

Program supported: Oceans Program

Academic Collaborator	NRC Principal Investigator	Associated NRC Research Centre
University of Waterloo	Farid Bensebaa, Lawrence Mak	Ocean, Coastal and River Engineering Research Centre

Project Description:

The Canada-Germany Hydrogen Alliance commits to export clean Canadian hydrogen by 2025. It is critical to evaluate the life cycle carbon emissions associated with hydrogen transmission at sea. In this project, we will focus on analyzing ammonia as a hydrogen carrier for the shipping purpose. A sensitivity analysis will be conducted to evaluate the life cycle carbon emissions in hydrogen and ammonia production in different provinces for shipping, long distance transmission to different markets and ammonia conversion to hydrogen as a final product. We will also study the impacts of using ammonia as a shipping fuel. This project is an extension of an existing NRC-MITACS-RWTH Aachen Globalink project on transatlantic ammonia shipping. The host (Prof. Wu) at the University of Waterloo will lead the collaboration and supervise the student, while the NRC PIs, Dr. Bensebaa and Dr. Mak will provide guidance on NRC LCA-TEA framework and ammonia shipping, respectively.

Decarbonization is the ultimate global shipping goal. While marine transport only contributes to 3% of transportation related GHG emissions, the movement of goods by sea also contributes to invasive species, water contamination, and noise pollution for marine life. Ships and ship building is one of Canada's largest blue economy industries and 98% of goods travel into Canada by ship. The purpose of the Intelligent Marine Assets technology theme is to reduce the environmental impact by optimizing maritime operations. This project complements by adding a commodity and potential fuel, i.e., ammonia to NRC's current work with respect to ships and shipping. This project will inform the potential of Canada to transport hydrogen in the form of ammonia by ship. If feasible and can be operationalized, commercializing this technology could drastically reduce GHG emissions from land-based industrial operations and marine transportation. Ammonia as a feedstock would become a growth market can pave the way to more hydrogen fuel infrastructure. Ocean health. Ocean wealth.

Student Profile:

We are looking for a student with the following skills/background:

- Studies in Mechanical or Chemical Engineering, or a closely related field
- Programs in Excel and Python
- Be enthusiastic in renewable energy and sustainability

Experience with process modeling is required; yet experiences with life-cycle analysis is a plus but optional.